

The South Bay Mercury Project: Using Biosentinels to Monitor Effects of Wetland Restoration for the South Bay Salt Pond Restoration Project



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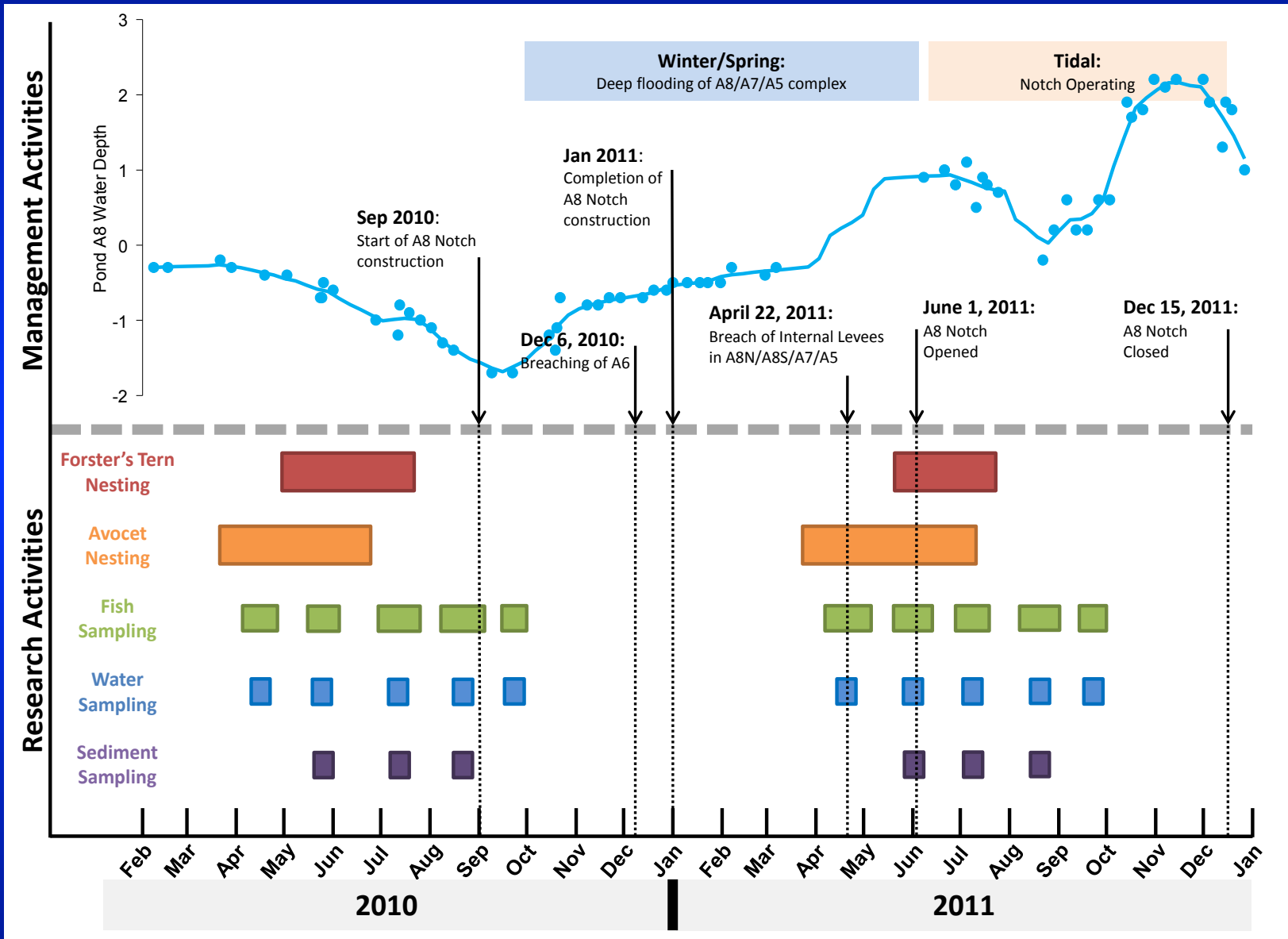
Background

- **South Bay Salt Pond Restoration Project converted Pond A8 to tidal flow & breached internal levees to create new Pond A8/A7/A5 Complex**
 - **Pond A8 Notch completed fall 2010 & opened June 1, 2011**
 - **Potential changes in mercury cycling as a result of management actions**
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- **Concerns about mercury**
 - **Remobilization of legacy mercury**
 - **Altered food web**
 - **Enhanced bioaccumulation**

Project Goals & Experimental Design

- Examine changes in mercury concentrations in sediment, water, fish, and birds
- Experimental Design:
 - Before (2010) vs after (2011) construction activities
 - Before vs after opening of Pond A8 Notch (June 1, 2011)
 - Restored Ponds (A7, A8) vs Reference Ponds (A3N, A16)
 - Impacted Slough (Alviso Slough) vs Reference Slough (Mallard Slough)

Restoration & Sampling Timeline for A8 Pond Complex

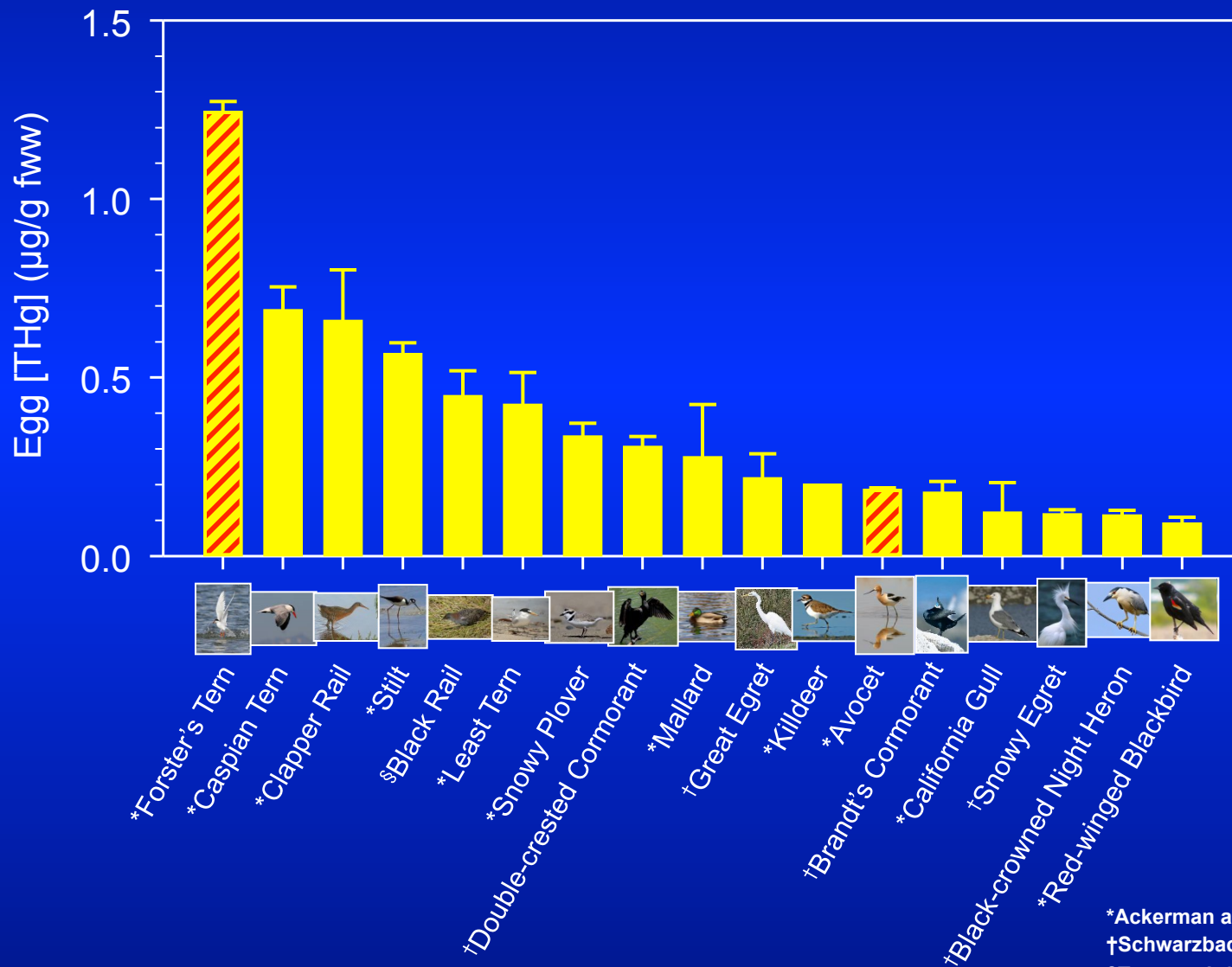


Bird Biosentinels



Bird Mercury Exposure in Bay

(San Francisco Bay: 17 species, $N > 4,000$)

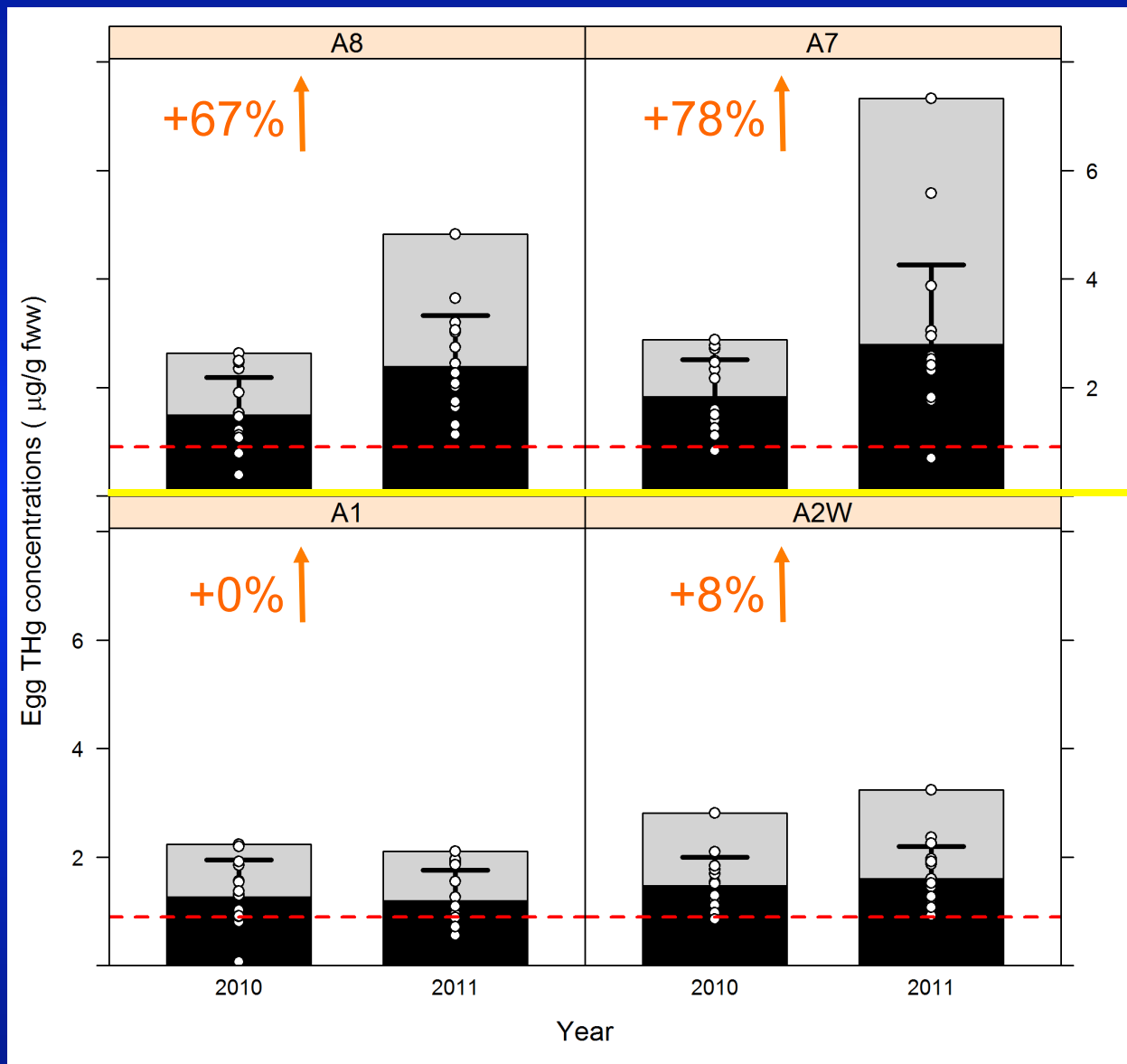


*Ackerman and Eagles-Smith 2008
 †Schwarzbach and Adelsbach 2003
 §Tsao et al. 2008

Locations of Bird Egg Sampling



Tern Egg Mercury Response to Wetland Restoration

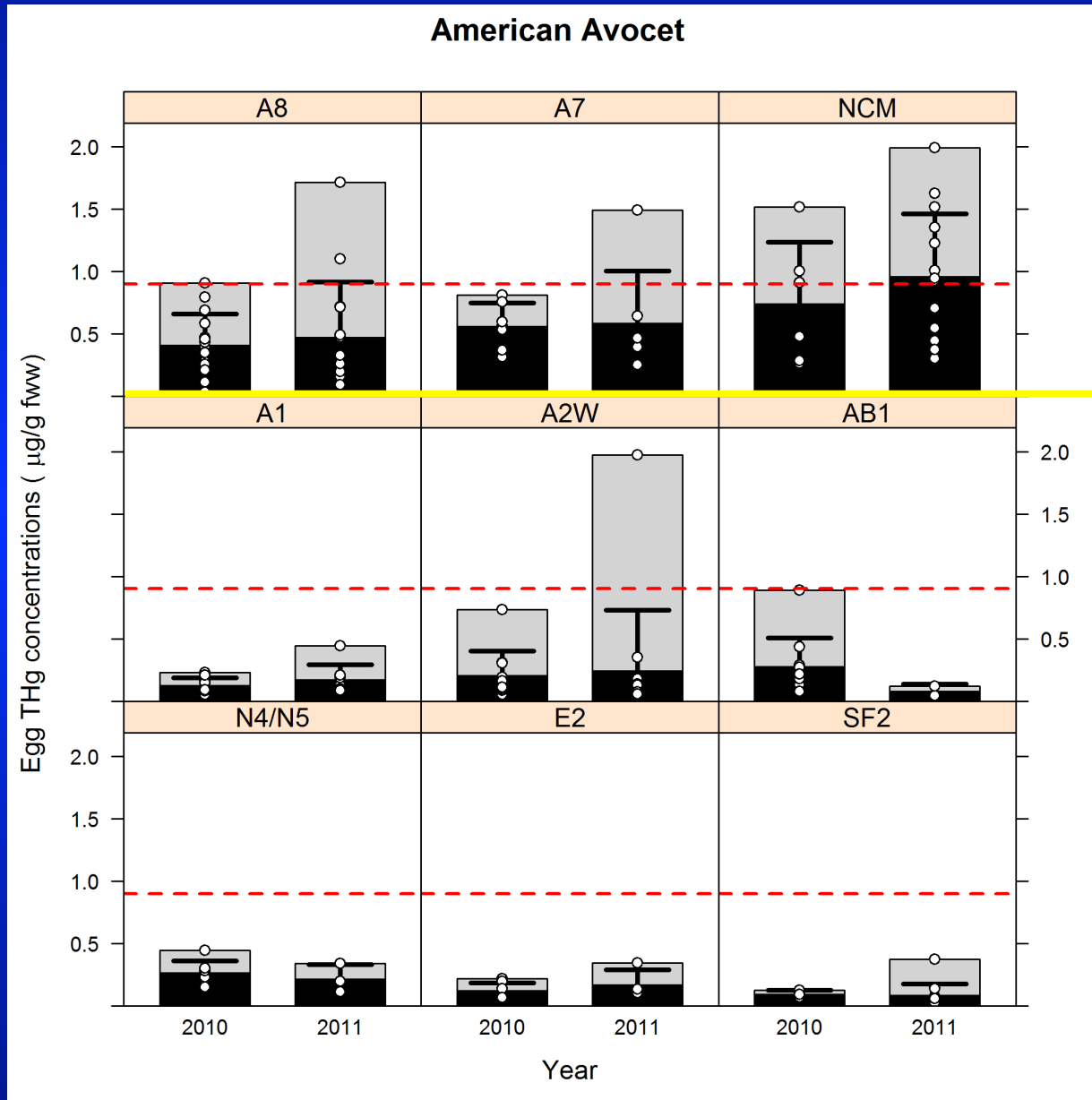


Restored
Wetlands

Control
Wetlands

Toxicity threshold = 0.9

Avocet Egg Mercury Response to Wetland Restoration



**Restored
Wetlands**

**Control
Wetlands**

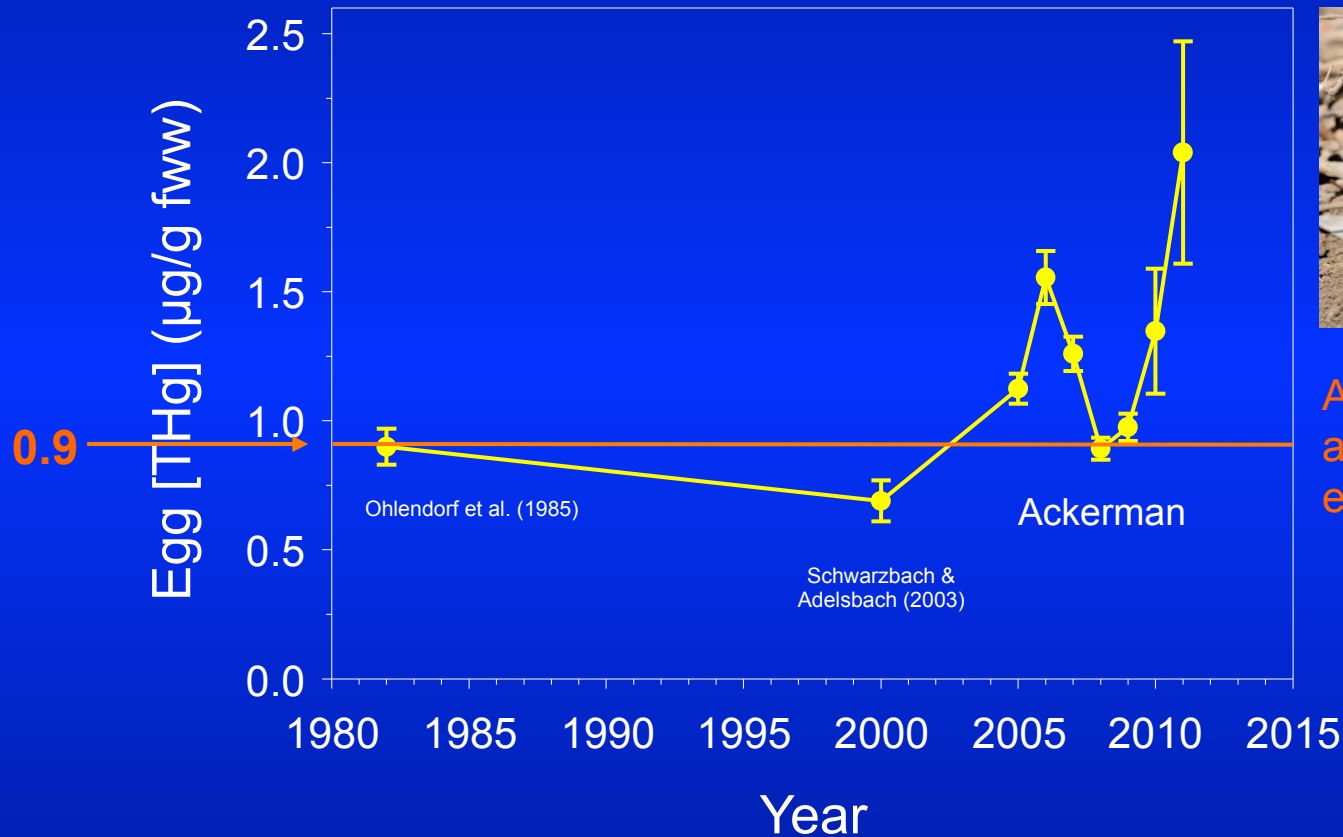
Toxicity threshold = 0.9

% of Eggs Above Toxicity Level in Restored Ponds

	<u>Before</u>		<u>After</u>
Terns	90%	→	100%
Avocets	5%	→	14%



Tern Egg Mercury Concentrations in San Francisco Bay May be Increasing



Annual mean egg Hg
above detectable
effects

*0.88 $\mu\text{g/g fww}$ = 10% reduction in egg hatchability and 18% reduction in nest survival

Fish Biosentinels

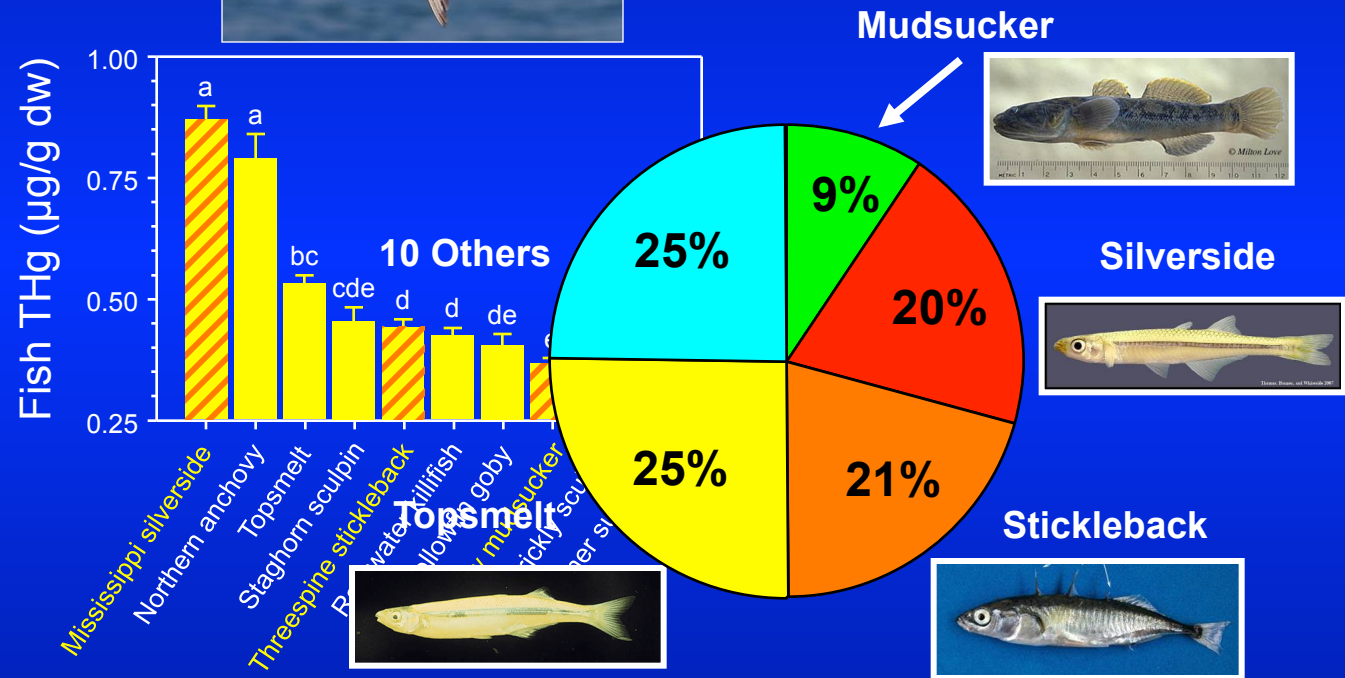


Fish Mercury Among Species & Tern Diet



Tern Diet

N=2880

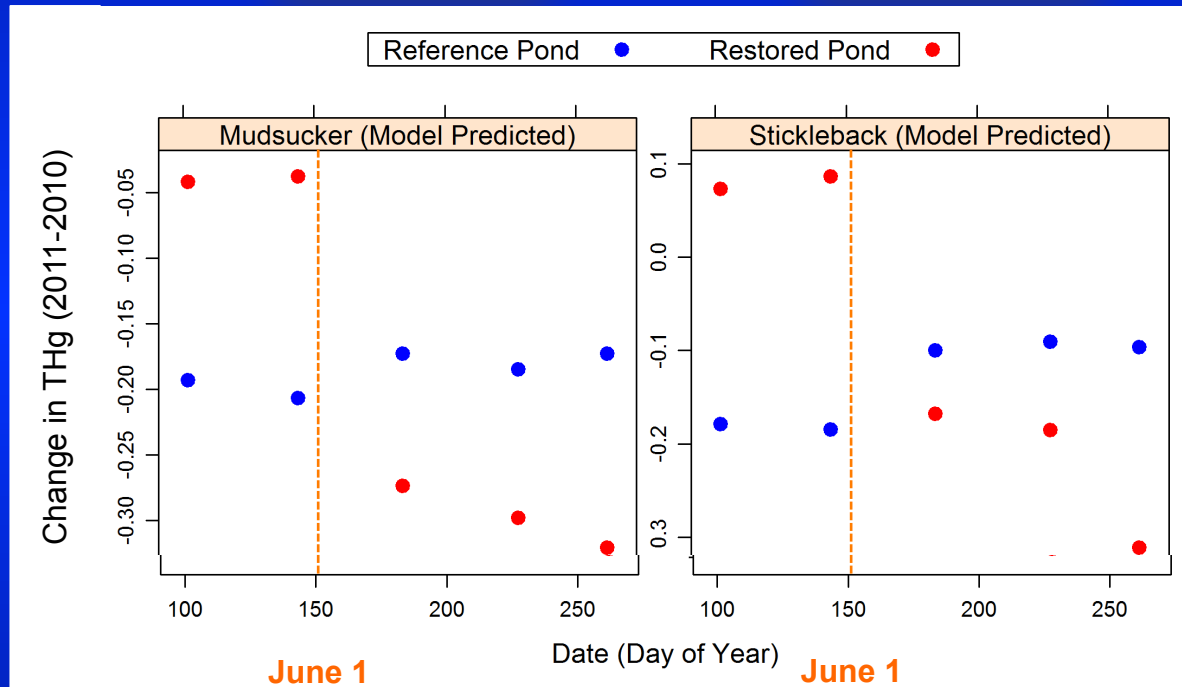


0.8=Hg effects on fish
1.2=Hg in fish effects birds

Locations of Fish Sampling



Fish Mercury Response to Wetland Restoration



Effects of A8 Restoration on Mercury

- Mercury increased dramatically in tern eggs after restoration actions between years; smaller trend for avocets
- Tern egg mercury concentrations well above toxic effect levels
- Pond fish mercury also increased substantially between years in Restored Ponds relative to Reference Ponds, but decreased once Pond A8 Notch was opened
- Fish mercury concentrations in Restored Ponds still very high relative to Reference Ponds, even after decline when Pond A8 Notch was opened
- Restoration Project incorporating results into management
 - A8 notch not fully opened
 - Continued monitoring of bird egg mercury incorporated to guide future management actions

Thank you!

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Report Available:

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<http://www.werc.usgs.gov/ProductDetails.aspx?ID=4908>

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